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ABSTRACT

This paper investigates deaf children of deaf parents who do not use formal sign language. Interactions of two deaf mother-deaf child dyads were videotaped every 2 months for 3 years from 14 and 22 months of age. Mothers and children both made extensive use of gestures. Findings included: (1) the rate of gesture sequencing was high, but even higher among the mothers; (2) representational gestures fell into distinct classes; (3) there were differences in ways each gesture was performed by mothers depending on its role as an action/verb or object/noun; (4) children produced very few potential pairs for comparison of noun-verb distinction of representational gestures; and (5) redundancy seemed to be the principle at work in mothers' use of gestures simultaneous with speech. (PB)

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Paper presented in the symposium " When is gesture like language?" at SRCD, Kansas City, April 1989.

Speech and gestural communication between oral deaf children and oral deaf mothers.

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The group we are studying, deaf children of deaf parents who do not use formal Sign, promises to shed important light on the question raised by the symposium, namely, when is gesture like language? We hope to demonstrate that the gestural system used by these dyads is in certain respects more language-like than the gestures that accompany the speech of hearing people, but in other respects has not acquired the properties of formal Signed languages. This population of children is to be distinguished from those studied by Goldin-Meadow and her colleagues, because her deaf subjects had hearing mothers, and our subjects are growing up in oral deaf families who do not use Sign. They have the same limited access to speech information, however, their mothers supplement speech with extensive gesture. We discuss the frequency of gesture, its nature as a symbol system, the possibility of a noun/verb distinction, and the grammar of sequences of gestures.

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1. The frequency of gestures in oral mother-child dyads

Two oral deaf mother-child pairs were videotaped in interaction every two months from time the children were 14 and 22 months, over the course of three years. Data from seven half-hour tapes from each pair constitute the oasis for this paper. Both mothers and children made extensive use of gesture in their interaction: the mothers average 16 gesture per minute of tape, and the children average 5.3 per minute. These figures are in stark contrast to Goldin-Meadow's figure of 1 gesture per minute for her hearing mothers. For these mothers, the majority of spoken utterances were accompanied by gesture, and for the children, gesture was the first and more elaborated form of communication. Figures 1 and 2 show the role that gesture plays vis a vis speech for the mothers, and Figures 3 and 4 show that relationship for the children. A complementary gesture is one that accompanies speech with the same message; a supplementary gesture provides information that the speech does not contain.

2. The frequency of gesture sequences

As reported previously by Goldin-Meadow and her colleagues, and in contrast to hearing children, deaf children combine their gestures into sequences conveying complex or relational meanings. In our subjects, the rate of gesture sequencing was quite high (32 and 29 per hour), but even higher in the case of the mothers (106 and 112 per hour). For Goldin-Meadow's sample, the rate of gesture sequences in her deaf

children always exceeded the rate in their hearing mothers. In our sample, the mothers are setting the pace. In both mothers and children, gesture+ gesture sequences are the norm, whereas gesture+ speech sequences, in which the two modalities collaborate to produce a complex meaning, are very rare. Hence there is at least the potential for a system of gestures elaborated beyond the single word.

3. Representational gesture

Unlike the case of adult hearing people in conversation studied by McNeill, the gestures used by these dyads are frequently representational. Beats and metaphorical gestures do not occur. Iconic gestures, those that resemble the event they denote, are less frequent than conventional or deictic gestures, but still occur at a rate of 2 per minute. (se Figures 5 and 6) Furthermore, the mothers' representational gestures increase as the children get older, rather than decrease (Figure 7). Interestingly, the iconic gesture type is the most likely to be redundant with speech (see Figures 8 and 9).

4. The nature of representational gestures

Goldin-Meadow has made a case in her work for counting all characterizing gestures (here, iconic) as representing predicates(verbs and adjectives) because of the uncertainty of making such decisions about part of speech in a non-conventional system. In our work, the mothers are typically speaking as they gesture, and we believed we could determine what component of the utterance each representational gesture stood for from the accompanying speech . So, for instance, the mother says " Go and get me the hammer " and she makes the motion of hammering as she utters the word "hammer". On another occasion, she says "You going to hammer that ball?" and accompanies the speech "hammer" with a gesture denoting hammering. From evidence such as this, and context, we argued that the representational gestures fell into distinct classes. Action is the favorite type of referent, but objects are also represented by action, as well as less frequently, by shape, typical place, and, rarely, size. Objects are represented by action in two ways: animate objects (and sometimes vehicles, e,g, airplane)are typically represented by the action they characteristically do, whereas inanimate objects are represented by the action typically done to them (hamburger-eat, car-drive, dial- dialling). (See Figures 10 and 11 for the proportions of iconic gestures across types of referents)

5. The form of representational gestures

Is there any evidence that the distinction between object and action representations has been conventionalized into a noun- verb distinction in the gesture of these dyads? We found 20 pairs of gestures

by the mothers in which we argued from the speech that one member of each pair represented the object, one represented the corresponding action. In all but two cases we also had several tokens on the tapes. We inspected each gesture pair to see if any difference was represented in the form (See Table 1). In 16 cases out of the 20, we argue that there is a difference in the way the gesture is performed, though there is some variety in the way that difference is captured. In general:

a. The action/verb tends to be more pronounced in motion than the object/noun- for instance, with a wider arc of motion, or a repetition of the action (for instance, the difference between "chop" and "axe" has this characteristic)

b. The action/verb tends to have a realistic direction, whereas the object/noun is more abstract in its representation of the direction. An example of that would be for the distinction between "pencil" (scribbles in one place, in air) versus "write" (scribbles down,as if on paper, and left to right)

c. The object/noun seems to incorporate more frequently some aspect of the object's size or shape. For instance "needle" includes a separation of the finger to show a typical length of needle, not done for "sew". For hamburger, the hands are held as if holding a hamburger as they are raised to the mouth.

Many of these distinctions are formalized in the morphology of existing Sign languages.

7. Is there a noun-verb distinction in the children's representational gestures?

Unfortunately the currently analyzed data do not allow a definite answer. The children produced very few potential pairs for comparison: only seven could be reliably identified in the tapes transcribed to date. Many of these were already represented in the mothers' repertoire and were often immediately following her use of them, so evidence is much weaker for the children's spontaneous invention of the distinctions. For at least one pair that was clearly distinct in the mother, her child made no apparent distinction. However, in the absence of speech from the child we cannot be as sure that we are classifying the gestures appropriately into the two classes in the first place. In our future work we hope to trace potential pairs over a wider number of tapes, in the hope that we may see a distinction emerging over time. It would not be too surprising if the children lacked the distinction at this stage, since some formal Sign language morphology doesn't appear until quite late in children's production.

8. Does the gesture system have its own grammar?

Redundancy seems to be the principle at work in the mothers' use of gesture simultaneous with speech. It is usually the case that the gestures are complementary (overlapping) with some aspect of the mother's spoken utterances. As mentioned, rarely do gesture and speech work together to make a complex meaning. Furthermore, when case grammars were written for the gesture sequences,and independently for the speech, there is considerable overlap in the orders. Even though they are rarely executed with absolute simultaneity , the gestural sequence tends to represent the meanings in the same order as the accompanying speech (se Figure 12) SVO order is typically preserved, as shown in Table 2 , which looks at ordering patterns in two sign sequences of actor, predicate and patient. In general, more elements are spoken than are gestured, but the picture is complicated by the fact that the gesture sometimes incorporates elements simultaneously, as when the word "cut" also represents the agent and the thing being cut.

In sum, the nature of the gestural system in the deaf mothers' communications with their deaf children seems to be on the "language-like" end of the continuum about which McNeill writes. It is generally linear, with discrete representational gestures that seem to encode at least partially a distinction between part of speech, and which combine to encode complex relational meanings. The order of the sequences, however, may be dictated by the accompanying English speech than by some independent grammar. The children's gestural repertoire is more advanced than their speech, conveys the same kinds of representational meanings as the mothers, and combines into frequent sequences that represent the same general case relations as two-word speech. Whether the children's system respects the noun/verb distinction, or is generated by an independent grammar, is still an open question.

Finally, it might be noted that this study concerns two distinct populations. The mothers are deaf , and may in fact be considered to represent Goldin-Meadow's subjects grown up, with a gestural system evolved for communication over a span of years. However they do have command of spoken English and that largely dictates the order of the gestures that they use to accompany their speech. In contrast the children do not know English, but they are distinguished from Goldin-Meadow's subjects by being exposed to a much richer system of gesture from their mothers. The opportunity thus exists to study the evolution of a gestural system to serve linguistic functions.

Figure 1.

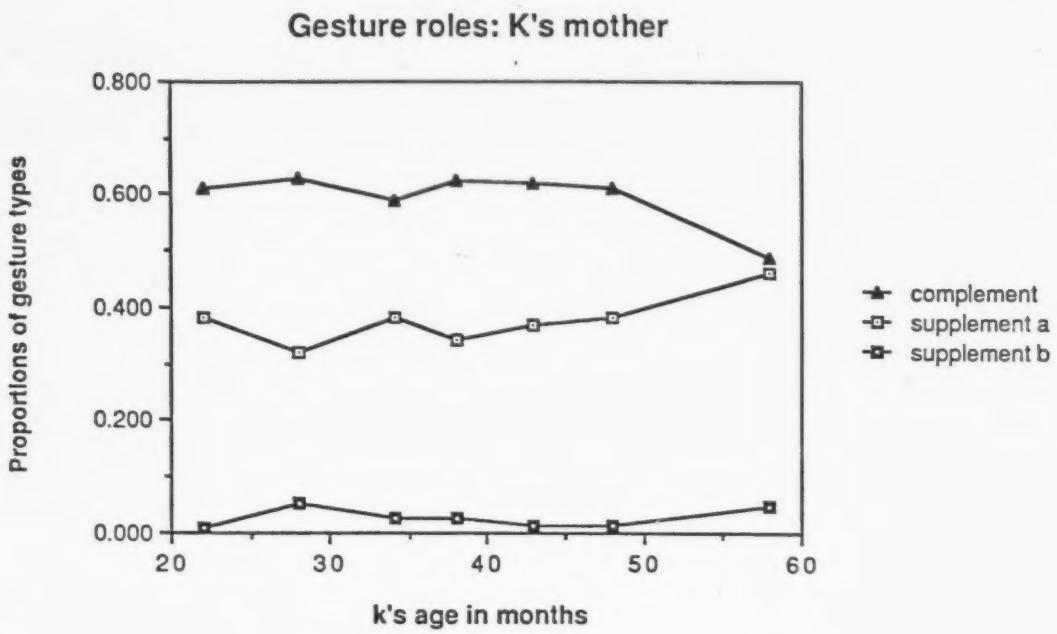

Gesture roles: K's mother
Proportions of gesture types
0.800
0.600
0.400
0.200
0.000
20
30
40
50
60
k's age in months
complement
supplement a
supplement b

Figure 2.

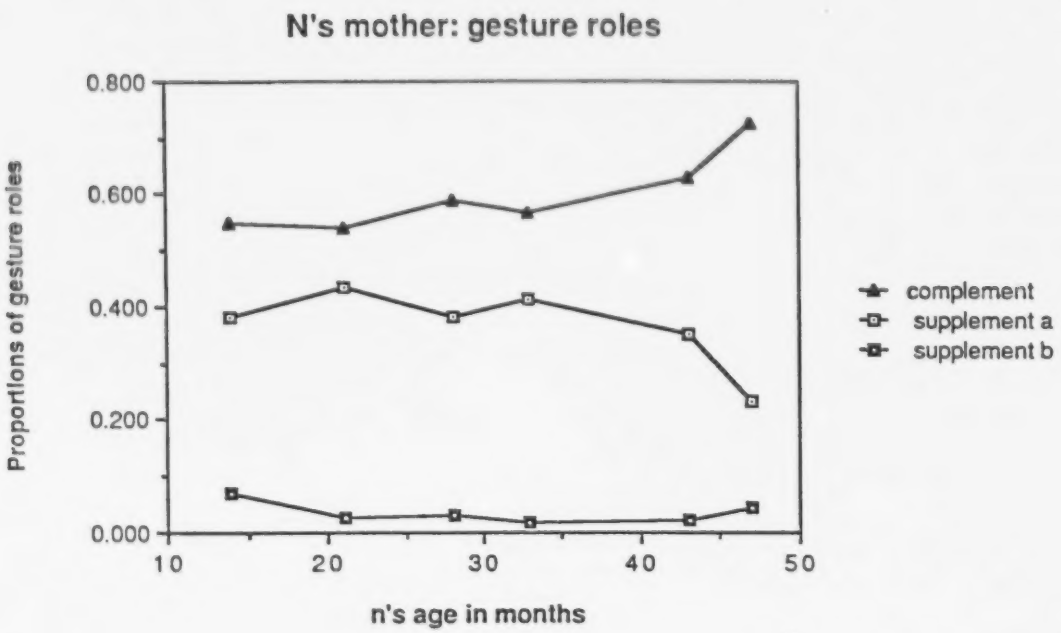

N's mother: gesture roles
Proportions of gesture roles
0.800
0.600
0.400
0.200
0.000
10
20
30
40
50
n's age in months
complement
supplement a
supplement b

Figure 3.

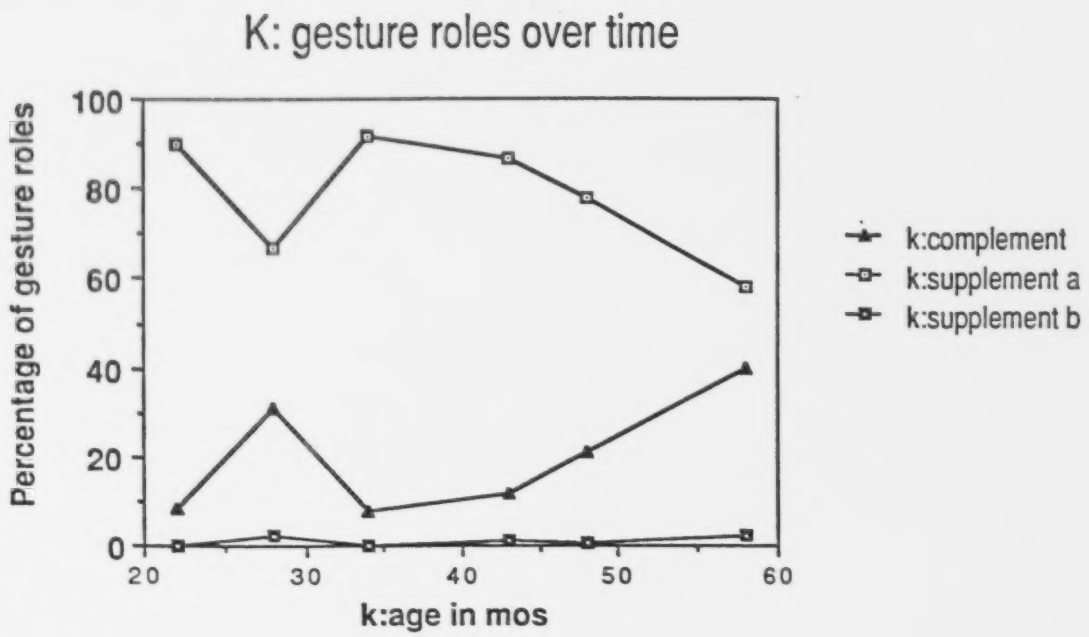

K: gesture roles over time
Percentage of gesture roles
100
80
60
40
20
0
20
30
40
50
60
k:age in mos
k:complement
k:supplement a
k:supplement b

Figure 4.

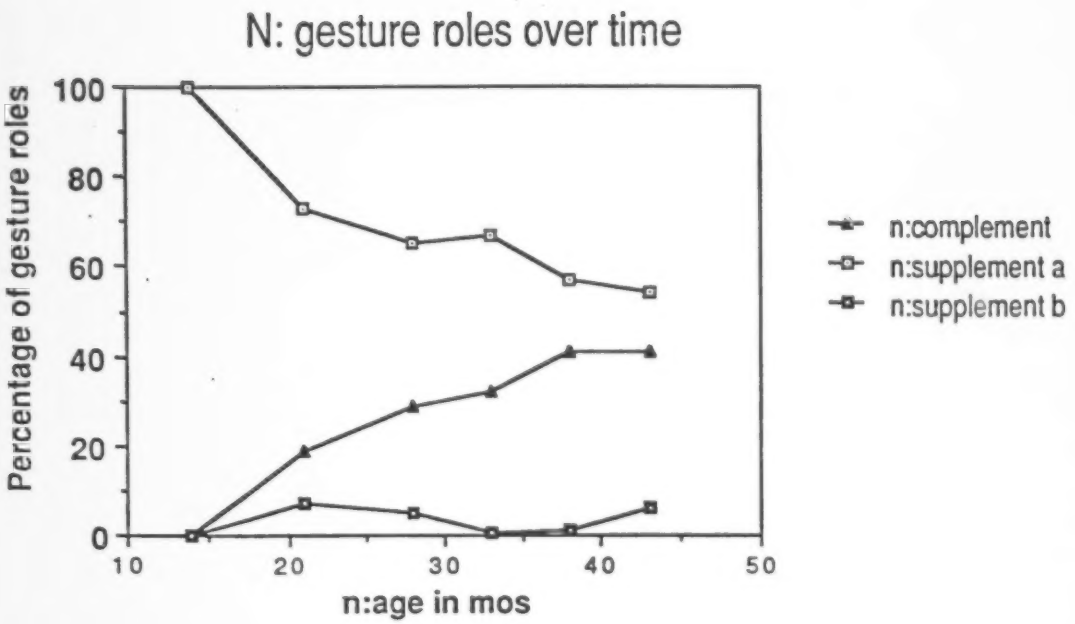

N: gesture roles over time
Percentage of gesture roles
100
80
60
40
20
0
10
20
30
40
50
n:age in mos
n:complement
n:supplement a
n:supplement b

Figure 5.

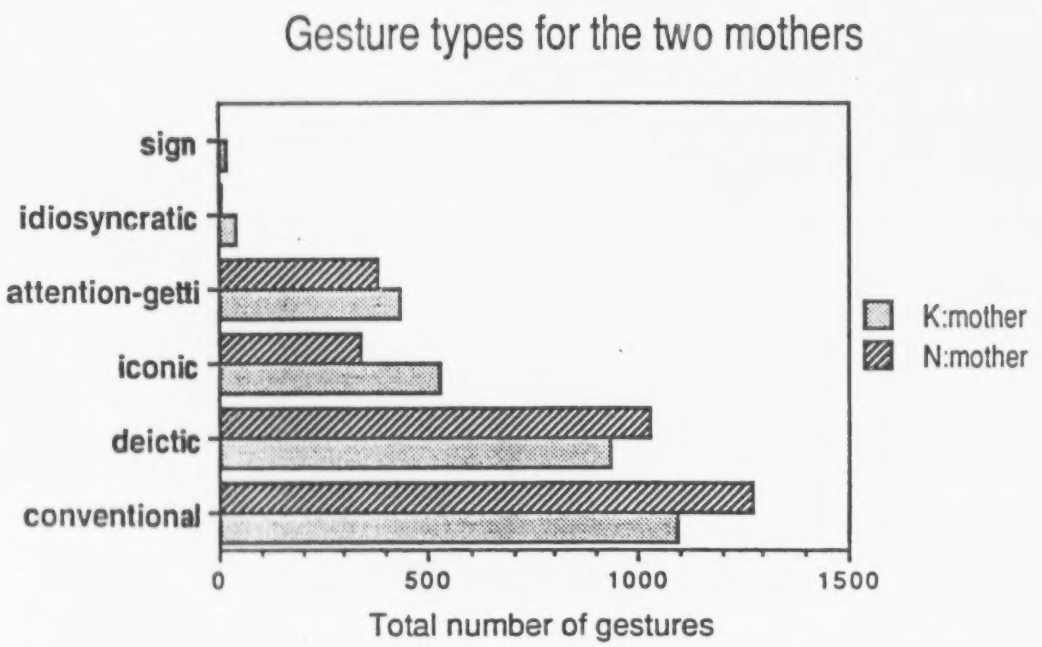

Gesture types for the two mothers
sign
idiosyncratic
attention-getti
iconic
deictic
conventional
0
500
1000
1500
Total number of gestures
K:mother
N:mother

Figure 6.

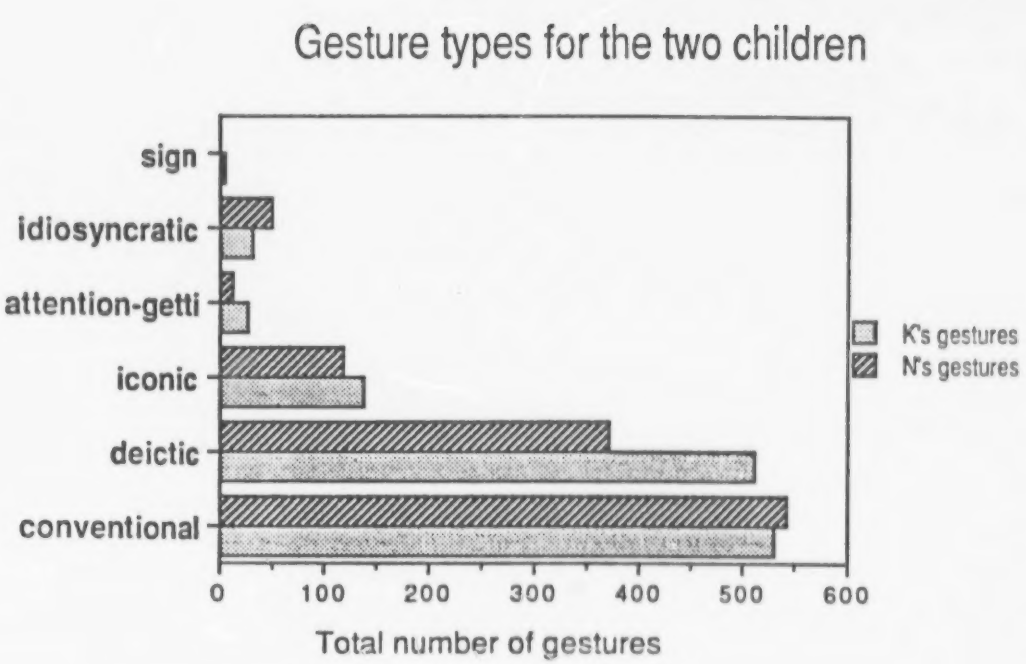

Gesture types for the two children
sign
idiosyncratic
attention-getti
iconic
deictic
conventional
0
100
200
300
400
500
600
Total number of gestures
K's gestures
N's gestures

Figure 7.

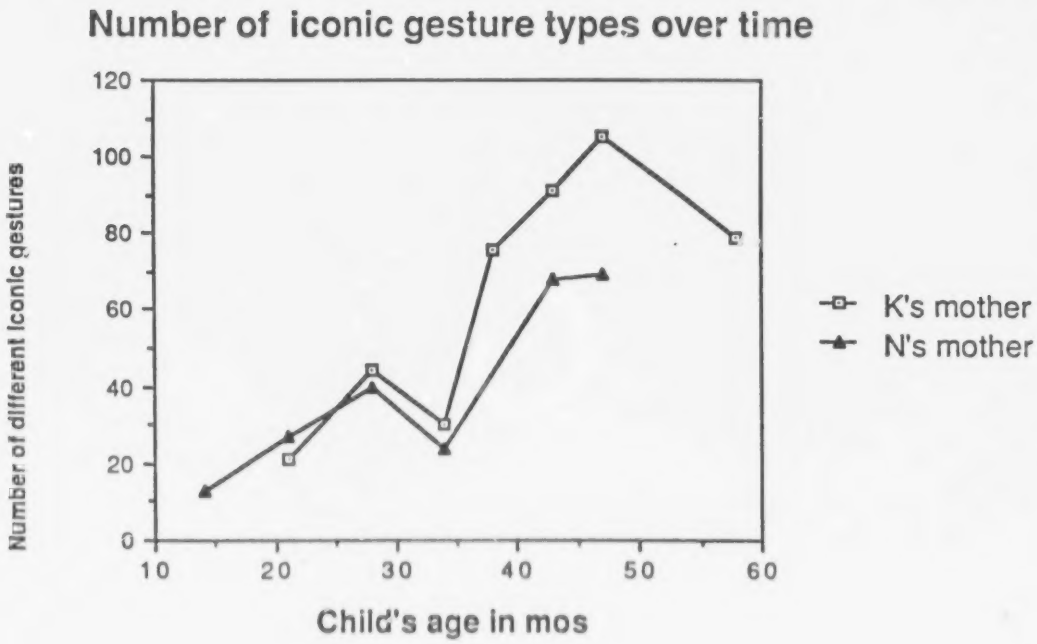

Number of iconic gesture types over time
Number of different iconic gestures
120
100
80
60
40
20
0
10
20
30
40
50
60
Child's age in mos
K's mother
N's mother

Figure 8.

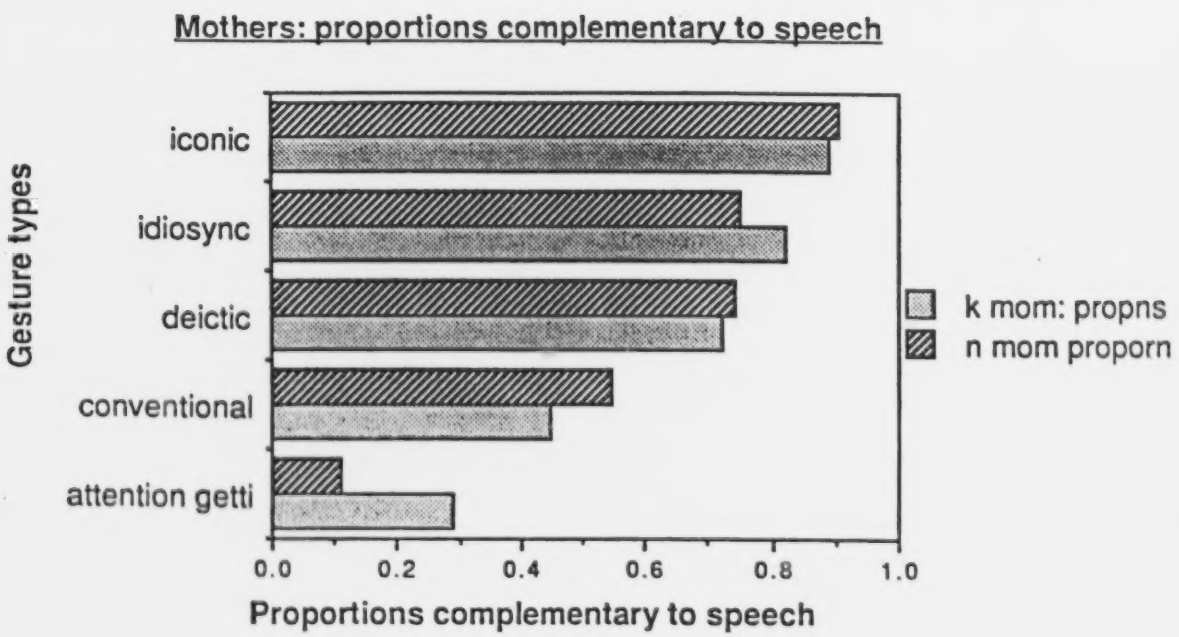

Mothers: proportions complementary to speech
Gesture types
iconic
idiosync
deictic
conventional
attention getti
0.0
0.2
0.4
0.6
0.8
1.0
Proportions complementary to speech
k mom: propns
n mom proporn

Figure 9.

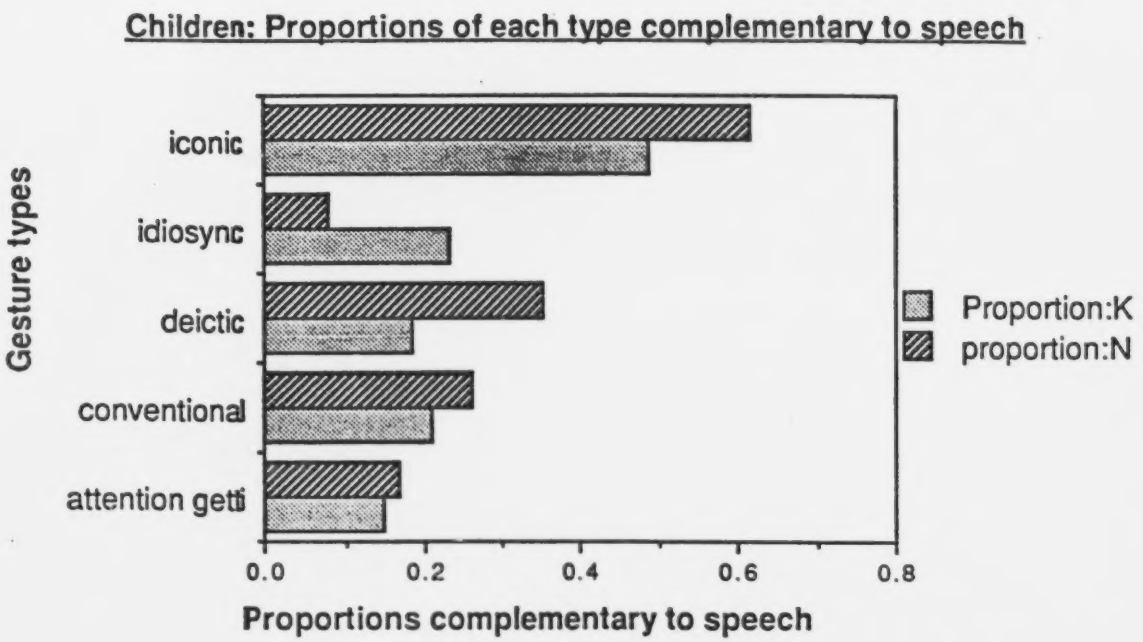

Children: Proportions of each type complementary to speech
Gesture types
iconic
idiosync
deictic
conventional
attention getti
0.0
0.2
0.4
0.6
0.8
Proportions complementary to speech
Proportion:K
proportion:N

Figure 10.

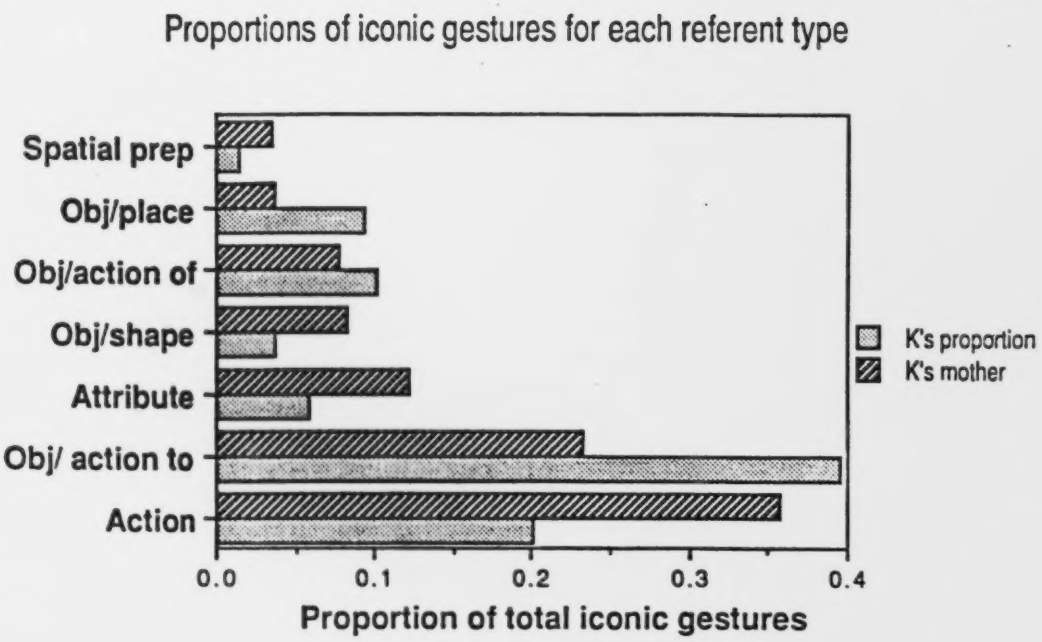

Proportions of iconic gestures for each referent type
Spatial prep
Obj/place
Obj/action of
Obj/shape
Attribute
Obj/ action to
Action
0.0
0.1
0.2
0.3
0.4
Proportion of total iconic gestures
K's proportion
K's mother

Figure 11.

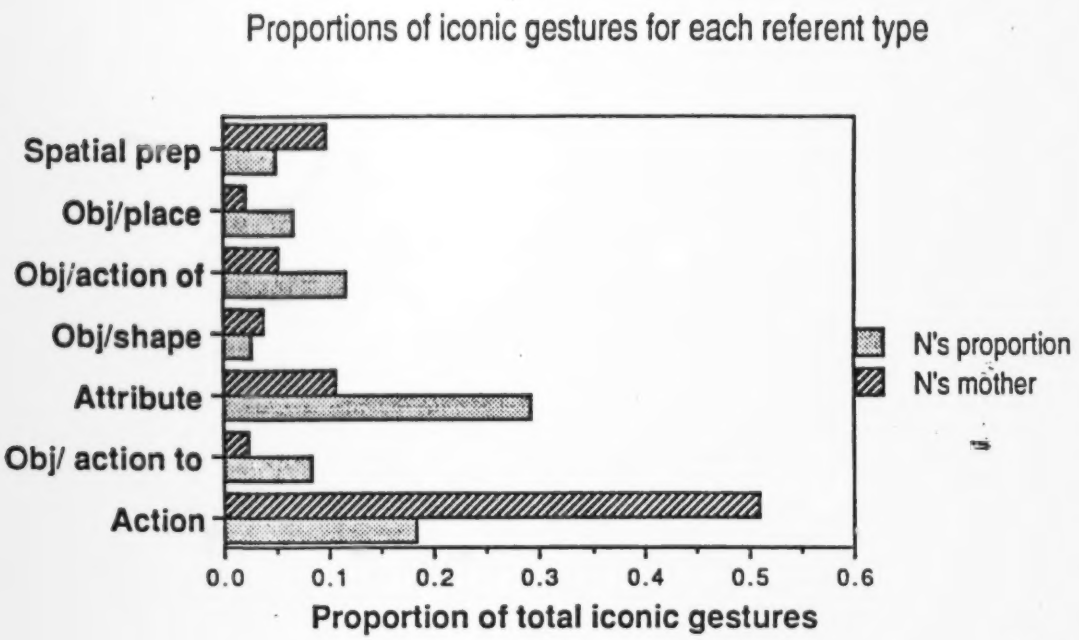

Proportions of iconic gestures for each referent type
Spatial prep
Obj/place
Obj/action of
Obj/shape
Attribute
Obj/ action to
Action
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Proportion of total iconic gestures
N's proportion
N's mother

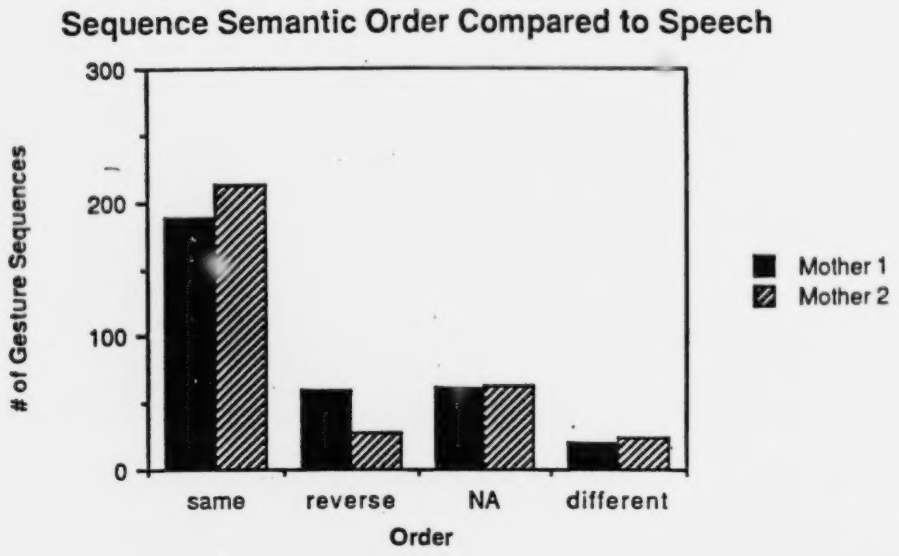
Table 1.

NOUN	VERB	DIFFERENCES
Firehose	To Spray	The verb is displayed with more animation, motion and aim.
Axe	To Chop	The verb incorporates multiple strokes whereas the noun is gestured with a single chop.
Key	To Turn	The hand illustrates the shape of the key when describing the noun. The fingers interact with an imaginary key in the case of the verb.
Needle	To Push Needle	With the noun the hand is slid backwards in the air. With the verb it is slid forwards towards the object.
Barrel	To Empty	The barrel handles are grasped and reference is made to size and shape in the case of the noun. The handles are also grasped with the verb but appropriate motion is added.
Glass	To Drink	The noun includes a stilted beat. The verb is naturally gestured.
Pony	To Ride	No apparent difference.
Sewing Needle	To Sew	The noun is displayed with a single air stitch and reference is made to size. The verb includes multiple stitching and direction.
Firetruck	To Drive	No apparent difference.

Table 1. continued

Violin	To Make Music	The noun is appropriately displayed. The verb is exaggerated with entire body movement.
Handcuffs	To Handcuff	No apparent difference.
Pencil	To Write	The verb is illustrated appropriately with a horizontal scribble. The noun is gestured with a vertical hand bob.
Knife	To Carve	A single slice to the side illustrates the noun. While the verb is more specifically done.
	To Cut	A single stroke forwards accompanies the warning, DON'T CUT YOURSELF.
Hamburger	To Eat	How a hamburger is held, manually describes the noun. The verb is vaguely represented with only a simple hand sweep to the mouth.
Bulls	To Fight	Only the forefingers are contacted when gesturing the noun. The verb incorporates the fists and added animation.
Rope	To Climb	No apparent difference.
Book	To Read	There is a very slight movement of the wrist in the case of the verb.
Dial	To Dial	The verb has direction.
Switch	To Switch	Same as above.
Wings	To Fly	The verb is gestured with more movement. The noun displays wing placement.

Figure 12.


Sequence Semantic Order Compared to Speech
300
200
100
0
# of Gesture Sequences
same
reverse
NA
different
Order
Mother 1
Mother 2

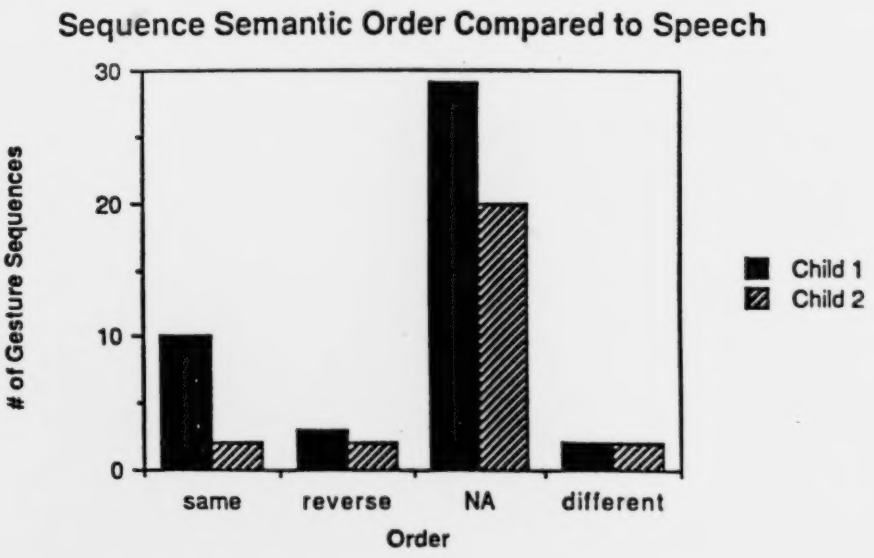

Sequence Semantic Order Compared to Speech
30
20
10
0
# of Gesture Sequences
same
reverse
NA
different
Order
Child 1
Child 2

Table 2.

Ordering Patterns in Simple Two-Sign Sentences

	APR	PRA	**AP**	PA	**PRP**	PPR
Mother 1	33	2	7	0	12	1
Mother 2	38	4	23	0	26	11

A=Actor PR=Predicate-a P=Patient. Each entry is the number of two-sign sentences following a particular sign order pattern (for example, actor precedes predicate-a) produced by each mother. Boldface are those relations adhering to the relation order commonly found in spoken English.